

Reminder: 2.1-2.3 Quiz on Block day.

If p , then q .

Converse If q , then p .

Inverse If not p , then not q .

Contra. If not q , then not p .

2.3 Extension--Truth tables

Conditional statements can be written using symbolic notation.

If p , then q . p —hypothesis q —conclusion

$p \rightarrow q$ "if p , then q " or " p implies q "

Symbolic Notation

Conditional $p \rightarrow q$

Converse $q \rightarrow p$

Inverse $\sim p \rightarrow \sim q$

Contrapositive $\sim q \rightarrow \sim p$

Biconditional $p \leftrightarrow q$

The truth value of a statement is either true (T) or false (F).
A truth table shows the conditions when a conditional statement is true.
It is only false when a true hypothesis produces a false conclusion.

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Truth Table for Conditional

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

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p	q	$p \rightarrow q$	Converse $q \rightarrow p$	Inverse $\sim p \rightarrow \sim q$	Contr. $\sim q \rightarrow \sim p$
T	T	T	T	T	T
T	F	F	F	F	F
F	T	T	T	T	T
F	F	T	F	T	T

Same

Examples:

Make a truth table for the logical statement.

$p \rightarrow \sim q$

p	q	$\sim q$	$p \rightarrow \sim q$
T	T	F	F
T	F	T	T
F	T	F	T
F	F	T	T

$\sim(p \rightarrow q)$

p	q	$p \rightarrow q$	$\sim(p \rightarrow q)$
T	T	T	F
T	F	F	T
F	T	T	F
F	F	T	F

Truth tables can also be made for conjunctions (and) and disjunctions (or).

"p and q" is true only when both p and q are true (symbolic: $p \wedge q$)

"p or q" is false only when both p and q are false (symbolic: $p \vee q$)

Conjunction		
p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction		
p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

Ex: $\sim p \vee q$

p	q	$\sim p$	$\sim p \vee q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

ex: $(p \vee q) \wedge \sim r$

p	q	r	$p \vee q$	$\sim r$	
T	T	T	T	F	F
T	F	T	T	F	F
T	T	F	T	T	T
T	F	F	T	T	T
F	T	T	F	F	F
F	F	T	F	F	F
F	T	F	F	T	T
F	F	F	F	T	F

HW

p95 #1-3, 7, 9, 10

7. $\sim p \rightarrow q$

1. **WRITING** Describe how to use symbolic notation to represent the contrapositive of a conditional statement.

WRITING STATEMENTS Use p and q to write the symbolic statement in words.

p : Polygon $ABCDE$ is equiangular and equilateral.

q : Polygon $ABCDE$ is a regular polygon.

2. $p \rightarrow q$ 3. $\sim p$

MAKING TRUTH TABLES Make a truth table for the logical statement.

7. $\sim p \rightarrow q$ 9. $\sim(q \rightarrow p)$

0. **LOGICAL EQUIVALENCE** The truth table shows that the conjunction " p and q " is true only when p and q are both true. It also shows that the disjunction " p or q " is false only when p and q are both false.

- Make a truth table for $\sim(p \text{ or } q)$.
- Make a truth table for $(\sim p \text{ and } \sim q)$.
- Show that $\sim(p \text{ or } q)$ and $(\sim p \text{ and } \sim q)$ are logically equivalent.

p	q	Conjunction p and q	Disjunction p or q
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	F